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# Next Generation Tunable Microwave Cavities for the search of Dark Matter Axions using Nonlinear Dielectric Films

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Experiments such as the Axion Dark Matter eXperiment (ADMX) utilize high-Q, tunable microwave cavities permeated by a strong magnetic field to stimulate the axion Primakoff interaction. The tunability of the cavity resonance frequency is crucial, allowing for efficient scanning of the large axion mass range. Future iterations of the ADMX microwave cavity experiment will require new methods to finely tune cavities. A promising method for achieving a sensitive frequency response is to coat the walls of the cylindrical cavity with a nonlinear dielectric material. The resonant frequency of the cavity depends on the inverse of the square root of the dielectric constant, while the dielectric constant depends on the temperature and voltage applied to the films. Thus, this tuning method would save space, introduce minimal noise and mitigate the thermal noise caused by the tuning rods. The purpose of this project is to characterize the behavior of a nonlinear dielectric material, Strontium Titanate SrTiO3, at low temperatures. Here I present the measured frequency response of several samples on a coplanar waveguide resonator and the analysis of the frequency spectra using simulations and an approximate analytic model of the resonator.

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